

## Patent Claims

1. A semiconductor component comprising a semiconductor body (1) and at least two electrodes (2, 3) between which are situated in the semiconductor body (1) at least one pn junction (4) and a voltage taking-up region (5) of the first conduction type, in which a space charge zone (6) propagates if a voltage that reverse-biases the pn junction (4) is applied to the electrodes (2, 3),  
wherein  
a temporarily effective area (9) of the first conduction type is provided in the voltage taking-up region (5), said area having, between its conduction band (L) and its valence band (V), centers (Z) which can trap free charge carriers in the event of flooding of the voltage taking-up region (5), but are discharged again in the event of propagation of the space charge zone (6), so that the area (9) is temporarily effective only in the event of a turn-off operation after flooding with free charge carriers.
2. The semiconductor component as claimed in claim 1, wherein  
a zone (7) doped more highly than the voltage taking-up region (5) is provided between said voltage taking-up region (5) and the electrode (3) for said region (5), and the temporarily effective area (9) is arranged before a junction (8) with the more highly doped zone (7).
3. The semiconductor component as claimed in claim 2, wherein  
the more highly doped zone (7) has the first conduction type.
4. The semiconductor component as claimed in claim 1 or 2,

wherein

the more highly doped zone (7) has the second conduction type opposite to the first conduction type.

5     5.    The semiconductor component as claimed in one of claims 1 to 4,  
      wherein  
      the first conduction type is the n conduction type.

10    6.    The semiconductor component as claimed in one of claims 1 to 5,  
      wherein  
      the centers (Z) are K centers.

15    7.    The semiconductor component as claimed in claim 6,  
      wherein  
      the K centers comprise the association of a carbon atom, an oxygen atom and two vacancies (COVV).

20    8.    The semiconductor component as claimed in claim 6 or 7,  
      wherein  
      the K centers (Z) are produced by irradiation with high-energy particles.

25    9.    The semiconductor component as claimed in claim 8,  
      wherein  
      the K centers (Z) are additionally produced by annealing at a temperature of more than 300°C  
30    subsequent to the irradiation.

      10. The semiconductor component as claimed in claim 8 or 9,  
      wherein  
35    the high-energy particles are protons or helium nuclei.

      11. The semiconductor component as claimed in claim 8 or 9,

wherein

the high-energy particles are carbon atoms which form K centers and contribute to the material of the semiconductor body (1).

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12. The semiconductor component as claimed in one of claims 1 to 11,

wherein

10 the temporarily effective area (9) is a field stopping area.

13. The semiconductor component as claimed in one of claims 1 to 12,

wherein

15 the temporarily effective area (9) is arranged at a depth of  $0.75 w_B$  to  $0.95 w_B$  from the pn junction (4), where  $w_B$  denotes the distance between the pn junction (4) and the opposite edge (8) of the voltage taking-up region (5).

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14. The semiconductor component as claimed in one of claims 1 to 13,

wherein

25 the temporarily effective area (9) has a doping concentration of between  $1 \text{ E } 14 \text{ cm}^{-3}$  and  $5 \text{ E } 15 \text{ cm}^{-3}$ .

15. The semiconductor component as claimed in claim 14,

wherein

30 the doping concentration lies between  $1 \text{ E } 14 \text{ cm}^{-3}$  and  $2 \text{ E } 15 \text{ cm}^{-3}$ .

16. The semiconductor component as claimed in one of claims 1, 2 and 5 to 15,

35 wherein

it is embodied as a diode, IGBT, thyristor or MOSFET.

17. The semiconductor component as claimed in claim 16,

wherein

in the semiconductor body (1) compensation regions (10)  
5 of the second conduction type are additionally provided  
in the voltage taking-up region (5).

18. The semiconductor component as claimed in one of  
claims 1 to 17,

10 wherein

a steady-state field stopping area (11) is additionally  
provided.

19. The semiconductor component as claimed in one of  
15 claims 1 to 18,

wherein

at least one further temporarily effective area (9') is  
provided in addition to the temporarily effective area  
(9).

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20. The semiconductor component as claimed in claim  
19,

wherein

the temporarily effective areas (9, 9') are produced by  
25 multiple implantations.

21. The semiconductor component as claimed in one of  
claims 1 to 20,

wherein

30 it is structured vertically.

22. The semiconductor component as claimed in one of  
claims 1 to 20,

wherein

35 it is structured laterally.

23. A method for production of the semiconductor  
component as claimed in one of claims 1 to 22,

wherein

K centers are introduced by implantation of high-energy particles into a weakly doped region (5) of a semiconductor body (1).

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24. The method as claimed in claim 23,  
wherein

the K centers (Z) are additionally produced by annealing at a temperature of more than 300°C  
10 subsequent to the irradiation.

25. The method as claimed in claim 23 or 24,  
wherein

protons or helium nuclei are provided as the high-  
15 energy particles.

26. The method as claimed in claim 23 or 24.  
wherein

carbon atoms which form K centers and contribute to the  
20 material of the semiconductor body (1) are provided as  
the high-energy particles.

27. The method as claimed in claim 24,  
wherein

25 the annealing is performed at a temperature of more  
than 420°C.

28. The method as claimed in one of claims 23 to 27,  
wherein

30 a multiple implantation is carried out for producing  
the temporarily effective area (9).

29. The method as claimed in one of claims 23 to 28,  
wherein

35 the implantation is carried out through a metal foil.

30. The method as claimed in one of claims 23 to 29,  
wherein

an implantation with protons for producing a steady-state field stopping area (11) is additionally carried out.

- 5 31. The method as claimed in one of claims 23 to 30, wherein  
the implantation is performed from the rear side of the semiconductor body, that is to say from the opposite side to the pn junction (4).